METHOD OF MAKING PROSTHETIC ARTICLES

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The present invention relates to a method of making prosthetic articles as, for example, artificial hands, gloves resembling hands, artificial feet, artificial fingers and similar articles. In the past, in making life-like artificial hands it was customary to make a plaster cast of a human hand and to then utilize this cast in the manufacture of artificial hands which might be formed of a number of different substances. This method of manufacture had many drawbacks, perhaps the chief of which was that the juncture line between the two halves of the mold were always present. Furthermore, the various minute ridges and depressions of the hand were eliminated in the manufacturing process so that the hand had merely a general resemblance to the human hand from which the artificial hand was made. In addition, of course, no coloring was present, or if an attempt were made to color the material from which the hand was made this color was general and not localized so as to bear a true resemblance to the original hand.

Our present process yields a product which has a striking resemblance to a natural human hand and which may be used either in the form of a glove to cover a mechanical hand or may be filled to form an artificial hand.

Although, in the following description the mode of making a glove will be described, it is to be understood that the same method is applicable to the formation of fingers, sleeves for the arm, feet, and other like articles.

It is an object of our invention to provide a method of making an artificial hand or glove which bears all of the markings such as ridges, depressions and colorations of a normal human hand.

It is a still further object of our invention to provide a method of making artificial hands, gloves and the like having coloration substantially identical to that of a normal human hand, particularly the coloration of the fingertips, knuckles and vein areas of the hand.

Other objects and features of our invention will appear when the following description is considered in connection with the annexed drawings in which—

Figure 1 is an illustration of a prosthetic glove in accordance with our invention; Figure 2 is a fragmentary cross sectional view of a hand showing the method of forming a mold later to be used in the manufacture of a glove; Figure 3 is a view similar to Figure 2 showing the means of removing the material placed upon the hand in Figure 2 to form a reversed mold;

Figure 4 illustrates the first step in the formation of a glove utilizing the reversed mold of Figure 3; Figure 5 is a fragmentary cross sectional view of the reversed mold and the coatings applied thereto showing particularly the application of color in selected areas particularly the application of a red or pinkish coloration in the fingertips, palms and knuckles of the hand; Figure 6 is a fragmentary, cross sectional view similar to Figure 5, showing the application of a sealing coat of latex over the color coat of Figure 5; Figure 7 is a view likewise similar to Figure 5 to illustrate the application of a blue color through a stencil to outline the vein structure of the hand; Figure 8 is a cross sectional view similar to Figure 6 showing the application of a sealing coat of latex over the veining coat of Figure 7; Figure 9 is a fragmentary cross sectional view illustrating the reversing of the reversible mold as well as the application of additional coats of latex to the interior surface of the glove formed thereon; and Figure 10 is a fragmentary cross sectional view of the finished glove showing in dotted lines the removal of the mold from the finished glove.

Referring now to the drawings there is shown in Figure 2 a fragmentary portion of a human hand 10 to which a coating of latex is applied in any convenient manner as by spraying through the nozzle 11. While a single coating is shown it will be understood that a number of coats may be applied with a drying period between successive coats. It will be observed that the latex coating 12 has its surface 13 next to the hand and a surface 15 exposed to the atmosphere.

When the latex coating 12 or coatings as the case may be, has dried it is removed from the hand in the manner illustrated in Figure 3 so that the surface 15 becomes the interior of the glove and the surface 13 the exterior. In other words, it is "peeled off" as is frequently done in removing rubber gloves.

The structure is at this time vulcanized and this vulcanized glove-like structure is the mold on which the ultimate gloves are to be formed. It will be clear from Figures 3 and 4 that this mold is a reversed replica of the original human hand, the surface 13 which was in contact with the hand now being the exterior of the mold and any elevations in the hand being represented by depressions in the mold while depressions in the hand are represented by elevations in the mold.
The mold 12 is now placed upon any convenient holder, which may be formed of wire or the like, and a coating 14 of latex sprayed thereon by using a nozzle such as nozzle 11. It is to be understood that although spraying is preferable this coating may be applied in any other manner as, for example, by dipping. The coating 14 will be the outer surface of the ultimate glove.

When the coating 14 has partially dried there is sprayed upon selected areas of the glove a red dye, or coloring, as Figure 5. The selected areas are, of course, those areas in which the normal human hand has a reddish coloration such as the fingertips, the palm of the hand and the knuckles.

Following this application of the reddish coloring a sealing coat of latex 17 is sprayed over the entire surface of the mold as is clearly shown in Figure 6. This coating, in addition to sealing in the coloring matter 16, serves to blend the coloring so that there is no sharp line of demarcation between the colored and uncolored areas. The coating may be permitted to dry before the following step takes place.

The next step in the process is to spray a blue color upon the surface in those areas in which the normal hand shows a bluish coloration due to the underlying vein structure. The coating of blue coloring matter 18 is shown in Figure 7 and is preferably applied by means or spraying from a nozzle such as 11 through a stencil 19. This blue coloring matter is applied to the hand wherever the vein structure is apparent in normal hands. Following the application of the blue coloring matter representative of the veins, there is applied another coating of latex to seal in and diffuse the blue coloring matter. The application of this sealing coat 21 is illustrated particularly in Figure 8.

When the coating 21 has dried, the reversible mold 12 together with the various coatings 14, 16, 17, 18 and 21 are turned inside out in exactly the same manner as one would turn a glove inside out, the result being illustrated in Figure 9.

Following this, the glove may be filled with latex which is then poured out and dried while being rotated to prevent any flow of the latex during drying, thereby forming an additional reinforcing coating 22 on the interior. This process may be repeated as many times as necessary to give the glove the proper thickness and strength. After a sufficient number of coatings have been thus applied, and in general three coatings will be sufficient, the mold 12 is removed from the various coatings, leaving a glove which is comprised of a number of layers of latex bonded together and having a coloring matter protected by at least two outer coatings of latex 18, this composite coating being generally designated 23, see Figures 1 and 10. This glove is then vulcanized and comprises the finished product which bears all the marks of the normal human hand and is additionally colored to resemble the colorations of such a hand. The mold may, of course, be used repeatedly but must of course be reversed after each complete glove has been removed therefrom.

Although it may be possible to form the glove without taking the mold until additional layers of latex have been sprayed on the exterior surface in the manner illustrated, for example, in Figure 8, this mode of operation is not advantageous because it tends to cause the fingers of a glove, for example, to become unduly thickened and to have an extremely poor appearance. On the contrary, when the mold is reversed, as indicated in Figure 9, the reversing tends to contract the already sprayed layers of latex such as 21 and the subsequent internal dipping or spraying of additional layers as 22 is effective to hold the externally sprayed layers in proper position and to produce a structure which is in every way preferable.

In speaking of spraying with latex it is to be understood that the latex is in a dispersion form and is either transparent or semi-transparent, further the latex should be either pre-vulcanized or compounded for vulcanization. It is further to be understood that other plastic materials with properties similar to those of latex may be substituted; or in fact any material capable of forming resilient films of a permanent nature may be used. When latex is used in the claims it is to be understood, therefore, that it refers to all of the types of materials above mentioned.

It is also to be understood that a separator such as water wax may be applied to the human hand before the latex is applied and to the mold before the first coating of latex is applied as shown in Figure 4, thus facilitating the stripping of the mold from the hand or the glove from the mold.

Although the process has been described in connection with the making of prosthetic articles and particularly a glove resembling a human hand, it is to be understood that other articles such as, for example, dolls' heads, animals' heads and the like may be made by the same process and that when the term "prosthetic" article is used in the claims it comprehends such articles.

We have herein described the embodiment of our invention and have described it solely in the formation of a glove resembling a human hand it is to be understood that other forms of the invention may be utilized and that other articles such as fingers and so forth may be made by the same process. Consequently, we wish to be limited not by the foregoing description which is given for the purposes of illustration only but solely by the appended claims.

What is claimed is:

1. A method of making prosthetic articles utilizing a reversible rubber mould which comprises applying a layer of latex over the exterior surface of the reversed mold, applying a layer of a first coloring matter upon localized areas of said first coat of latex, said areas being in conformance with those having said coloring matter in the article simulated, applying a sealing coat of latex over the coloring matter and the underlying latex layer, applying a second coloring matter in localized areas in accordance with such second coloring in the article simulated, applying a sealing coat of latex over said second coloring matter and the underlying latex layer, reversing the mold to thereby make the applied latex layers lie on the interior surface of the mold, the last applied layer being innermost, applying an additional plurality of latex layers to the interior surface of the article, removing the mold from the structure and vulcanizing the thus formed composite structure.

2. The method of making prosthetic articles utilizing a reversible rubber mold which comprises applying all external layers of latex upon the exterior surface of the reversed mold, applying at least one layer of coloring matter upon localized areas of said first coat of latex, said areas being in conformance with those having such coloration in the article simulated, applying seal-
ing coats of latex over the coloring matter and the underlying latex layer, reversing the mold to thereby make the applied latex layers lie on the interior surface of the mold, the last applied layer being innermost, applying an additional plurality of latex layers to the interior surface of the structure, and stripping the mold from the structure.

4. The method of making prosthetic articles utilizing a reversible mold which comprises applying a plurality of layers of latex upon the exterior surface of the reversed mold, reversing the mold to thereby make the first applied latex layer lie on the interior surface of the mold, the last applied layer being innermost, applying at least one additional latex layer to the interior surface of the structure, and stripping the mold from the structure.

5. The method of making prosthetic articles of the class described, which comprises applying a plurality of layers of latex upon an article to be simulated used as a mold, stripping said composite latex structure from the mold, reversing said structure in the process, vulcanizing said structure and thereupon using it as a reversible mold, applying a coating of latex on said reversed mold, then applying a first coloring matter upon said coating of latex in areas which have said first color in the article simulated, applying a sealing coat of latex over said coloring matter and the underlying latex layer, the coating of latex and coloring matter being outermost, and reverses, applying a layer of latex upon the exterior surface of the reversed mold, applying a layer of a first coloring matter upon localized areas of said first coat of latex, applying a second coloring matter in localized areas in accordance with such coloring matter in the article simulated, applying a sealing coat of latex over said second coloring matter and the underlying latex layer, reversing the mold to thereby make the applied latex layers lie on the interior surface of the mold, the last applied layer being innermost, applying at least one additional latex layer to the interior surface of the structure, and stripping the mold from the structure.

6. The method of making prosthetic articles of the class described, which comprises applying a plurality of layers of latex upon an article to be simulated used as a mold, stripping said composite latex structure from the mold, reversing said structure in the process, vulcanizing said structure and thereupon utilizing it as a reversible mold, applying a coating of latex on said reversed mold, then applying a coloring matter upon said coating of latex in areas which have such color in the article simulated, applying a sealing coat of latex over said coloring matter and the underlying latex layer, turning the mold inside out, building up additional layers of latex upon the now interior surface of the structure, and stripping the mold from the exterior of the structure.

6. The method of making prosthetic gloves resembling human hands which method utilizes a reversible vulcanized rubber mold, which comprises, applying a layer of latex upon the exterior surface of the reversed mold, applying a layer of a first coloring matter upon localized areas of said first coat of latex, applying a second coloring matter in localized areas of said second coat of latex, applying a sealing coat of latex over said second coloring matter and the underlying latex layer, reversing the mold to thereby make the applied latex layers lie on the interior surface of the mold, the last applied layer being innermost, applying at least one additional latex layer to the interior surface of the structure, and stripping the mold from the structure and vulcanizing the thus formed composite structure.

7. The method of making prosthetic articles utilizing a reversible rubber mold which comprises, applying at least one layer of latex upon the exterior surface of the reversed mold, reversing the mold to thereby make the first applied latex layer lie on the interior surface of the mold, the last applied layer being innermost, applying an additional plurality of latex layers to the interior surface of the structure, stripping the mold from the structure and vulcanizing the thus formed composite structure.

8. The method of making prosthetic articles using a reversible vulcanized rubber mold which comprises applying at least one layer of latex upon the exterior surface of the reversed mold, reversing the mold to thereby make the first applied latex layer lie on the interior surface of the mold, the last applied layer being innermost, applying an additional plurality of latex layers to the interior surface of the structure and stripping the mold from the structure.

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